
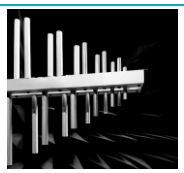
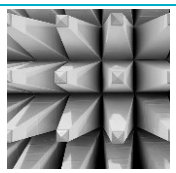

cetecom advanced

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

lac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

Test report no.: 1-7216_23-01-03

Testing laboratory

cetecom advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.
ISED Testing Laboratory Recognized Listing Number: DE0001
FCC designation number: DE0002

Applicant

FEIG ELECTRONIC GmbH
Industriestraße 1a
35781 Weilburg / GERMANY
Phone: +49 6471 31 09-0
Contact: Manuel Haertlé
e-mail: manuel.haertle@feig.de

Manufacturer

FEIG ELECTRONIC GmbH
Industriestraße 1a
35781 Weilburg / GERMANY

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**UHF RFID Reader**
Model name:	**ID ISC.LRU1002-FCC**
FCC ID:	**PJMLRU1002A**
ISED certification number:	**6633A-LRU1002A**
Frequency:	ISM Band 902 – 928 MHz
Technology tested:	RFID
Antenna:	Integrated antenna
Power supply:	24 V DC, by external power supply
Temperature range:	22°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

p.o.

cn=Marco Bertolino, o=cetecom advanced GmbH, ou=BTL-230530, email=marco.bertolino@cetecomadvanced.com, c=DE
2024.02.13 13:16:29 +01'00'

Christoph Schneider
Lab Manager
Radio Labs

Test performed:

cn=Joachim Wolsdorfer, o=cetecom advanced GmbH, ou=WLD-230605, email=joachim.wolsdorfer@cetecomadvanced.com, c=DE
2024.02.13 08:24:53 +01'00'

Hans-Joachim Wolsdorfer
Lab Manager
Radio Labs

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2024-01-02
Date of receipt of test item:	2024-01-17
Start of test:*	2024-01-18
End of test:*	2024-02-05
Person(s) present during the test:	-/-

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

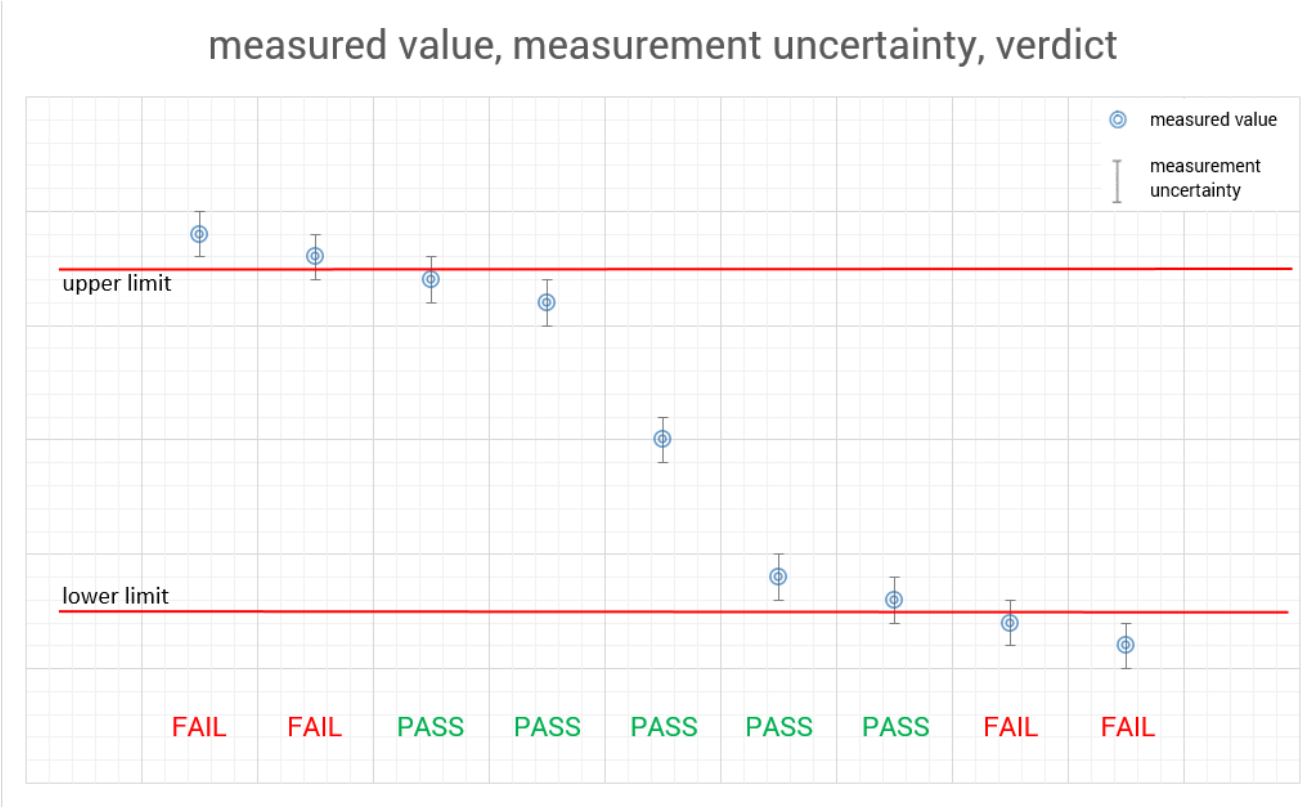
3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 3	August 2023	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



5 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+21 °C during room temperature tests no tests under extreme conditions required no tests under extreme conditions required
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC, by external power supply no tests under extreme conditions required no tests under extreme conditions required

6 Test item

6.1 General description

Kind of test item	:	UHF RFID Reader
Model name	:	ID ISC.LRU1002-FCC
HMN	:	-/-
PMN	:	ID ISC.LRU1002-FCC
HVIN	:	ID LRU1002A
FVIN	:	-/-
S/N serial number	:	Rad. 9062481
Hardware status	:	-/-
Software status	:	-/-
Firmware status	:	-/-
Frequency band	:	ISM Band 902 – 928 MHz
Type of radio transmission Use of frequency spectrum	: :	FHSS
Type of modulation	:	ASK
Number of channels	:	50
Antenna	:	Integrated antenna
Power supply	:	24 V DC, by external power supply
Temperature range	:	21°C

6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

Annex A101 - Photographs - 1-7216_23-01-01_TR1-A101-R1.pdf
Annex A102 - Photographs - 1-7216_23-01-01_TR1-A102-R1.pdf
Annex A103 - Photographs - 1-7216_23-01-01_TR1-A103-R1.pdf

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

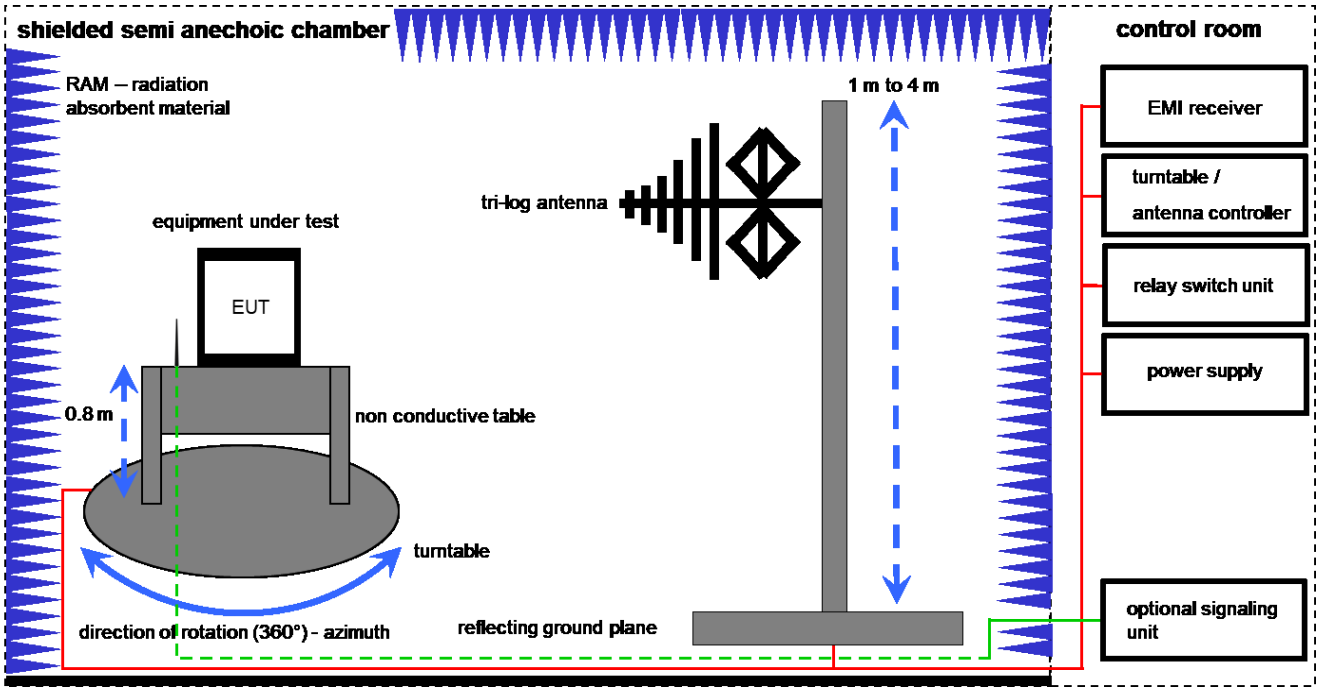
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter
EMC32 software version: 10.59.00

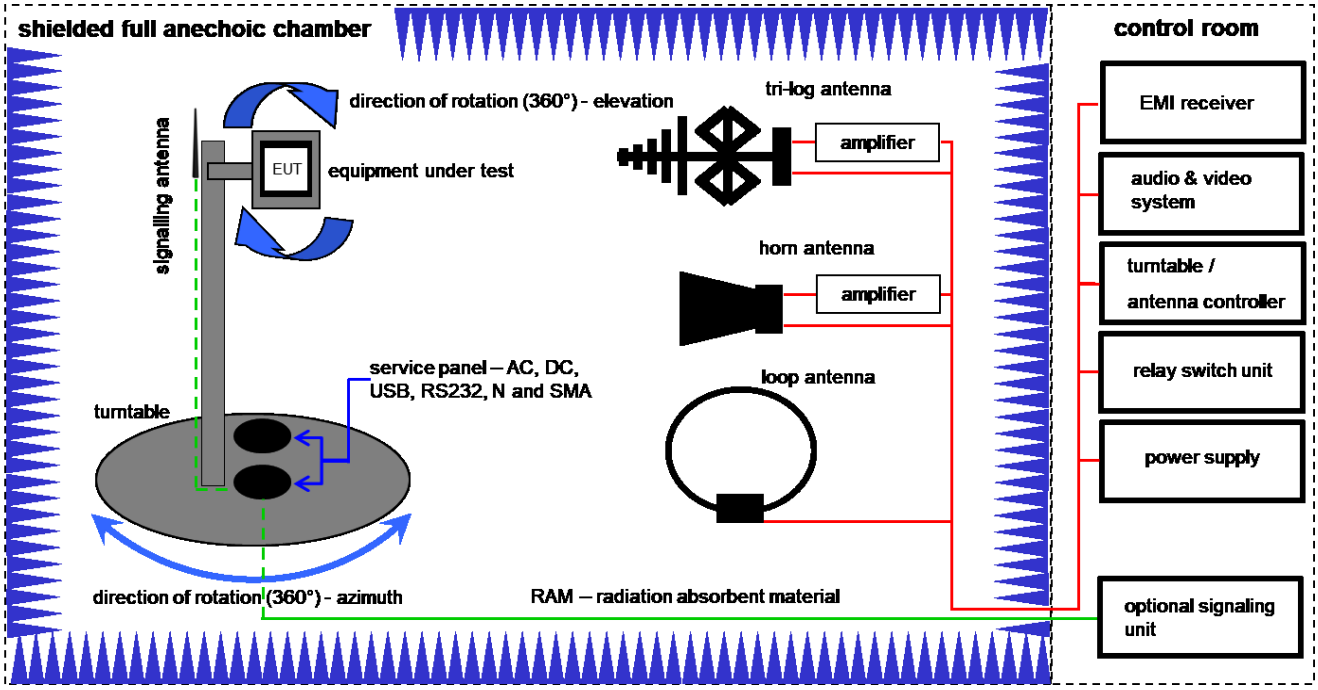
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Semi anechoic chamber	3000023	MWB AG		300000551	ne	-/-	-/-
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vIKI!	23.05.2023	31.05.2025
7	A	Turntable	2089-4.0	EMCO		300004394	ne	-/-	-/-
8	A	PC	TecLine	F+W		300004388	ne	-/-	-/-
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	06.12.2023	31.12.2024

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter, tri-log antenna 3 meter; loop antenna 3 meter

FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	02.08.2023	31.08.2025
2	A,B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A,B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	A,B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2023	31.12.2024
5	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003854	vIKI!	04.02.2022	29.02.2024
6	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
7	A,B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
8	C	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3089	300000307	vIKI!	11.02.2022	29.02.2024
9	C	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
10	A,B	NEXIO EMV-Software	BAT EMC V2022.0.32.0	Nexio		300004682	ne	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Carrier frequency separation	± 21.5 kHz
Number of hopping channels	-/-
Spectrum bandwidth	± 21.5 kHz absolute; ± 15.0 kHz relative
Maximum output power	± 1 dB
Detailed conducted spurious emissions @ the band edge	± 1 dB
Band edge compliance radiated	± 3 dB
Spurious emissions conducted	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB

10 Summary of measurement results

☐	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☒	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS - 247, Issue 2	Passed	2024-02-13	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (b)	**Antenna gain**	Nominal	Nominal	CW modulated	☐	☐	☐	☒	-/-
§15.247(a)(1) RSS - 247 / 5.1 (b)	**Carrier frequency separation**	Nominal	Nominal	TX hopping	☐	☐	☐	☒	-/-
§15.247(a)(1) RSS - 247 / 5.1 (d)	**Number of hopping channels**	Nominal	Nominal	TX hopping	☐	☐	☐	☒	-/-
§15.247(a)(1) (iii) RSS - 247 / 5.1 (d)	**Time of occupancy (dwell time)**	Nominal	Nominal	TX hopping	☐	☐	☐	☒	-/-
§15.247(a)(1) RSS - 247 / 5.1 (a)	**Spectrum bandwidth of a FHSS system bandwidth**	Nominal	Nominal	CW modulated	☐	☐	☐	☒	-/-
§15.247(b)(1) RSS - 247 / 5.4 (b)	**Maximum output power**	Nominal	Nominal	CW modulated	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	**Detailed spurious emissions @ the band edge - conducted**	Nominal	Nominal	TX hopping	☐	☐	☐	☒	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	**Band edge compliance radiated**	Nominal	Nominal	-/-	☐	☐	☒	☐	No restricted band nearby
§15.247(d) RSS - 247 / 5.5	Spurious emissions conducted	Nominal	Nominal	CW modulated	☐	☐	☐	☒	-/-
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	Nominal	Nominal	CW modulated	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	Nominal	Nominal	CW modulated / RX mode	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated above 1 GHz	Nominal	Nominal	CW modulated / RX mode	☒	☐	☐	☐	-/-

§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	Nominal	Nominal	-/-	☐	☐	☐	☒	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

11 RF measurements

11.1 Additional comments

Reference documents: None

Special test descriptions: The EUT has 4 antenna ports. These ports can be used single or in a time division multiplexed mode where only one port is active in a time slot. All ports are equal in the RF performance. All measurements were performed in single port mode on Port1.

Configuration descriptions: The EUT is designed to be used in combination with different antennas. All conducted measurements were performed with the highest output power supported by the EUT (1 Watt = 30 dBm, conducted output power limit).
For the spurious emission tests radiated we used the following antenna models:

- ID ANT.U LOCFIELD 037-080-28-FCC7-080-28-FCC
- ID ANT.U82/82

connected through UHF Antenna Cable ID ISC.ANT.C6 (length 6m)

Test mode: ☒ Special software is used.
EUT is transmitting pseudo random data by itself

12 Measurement results

12.1 Maximum Output Power

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 7.2 B
Measurement uncertainty:	See chapter 9

Limits:

FCC	IC
Maximum Output Power Conducted	
For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	

Result:

with antenna ANT.U82/82:

Test Conditions		EIRP		
		Low channel	Middle channel	High channel
T_{nom}	V_{nom}	9.44 dBm	9.58 dBm	9.89 dBm

with antenna 037-080-28-FCC:

Test Conditions		EIRP		
		Low channel	Middle channel	High channel
T_{nom}	V_{nom}	29.80 dBm	29.74 dBm	29.36 dBm

12.2 Spurious Emissions Radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channels are 00; 39 and 78. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 7.2 A
Measurement uncertainty:	See chapter 9

Limits:

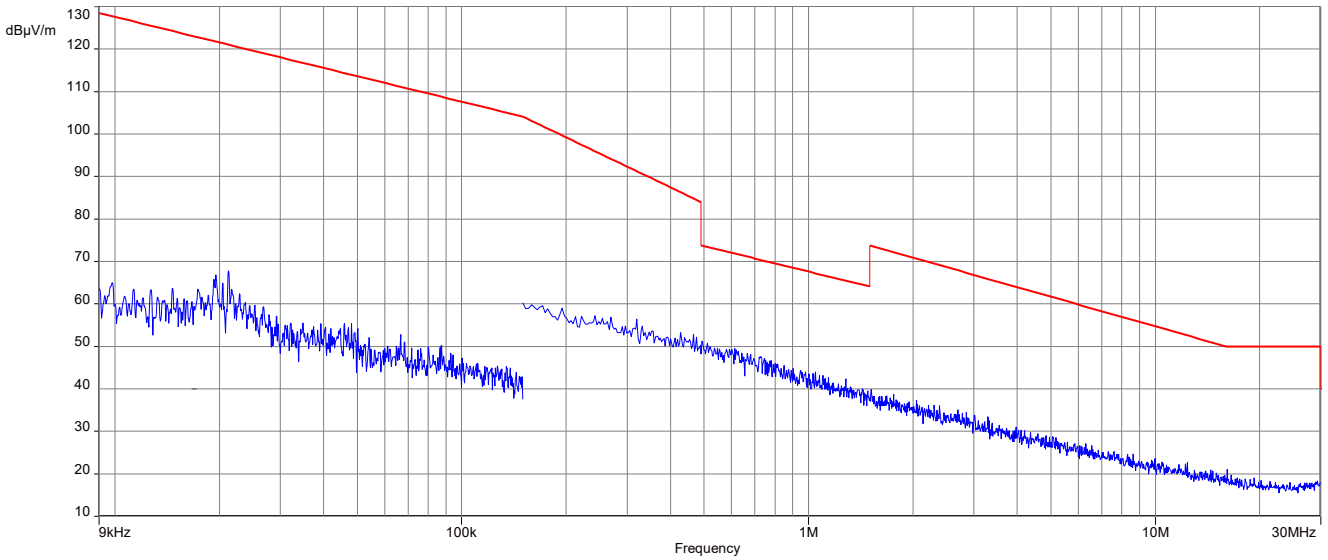
FCC		IC
TX spurious emissions radiated < 30 MHz		
Frequency (MHz)	Field strength (µV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Result:

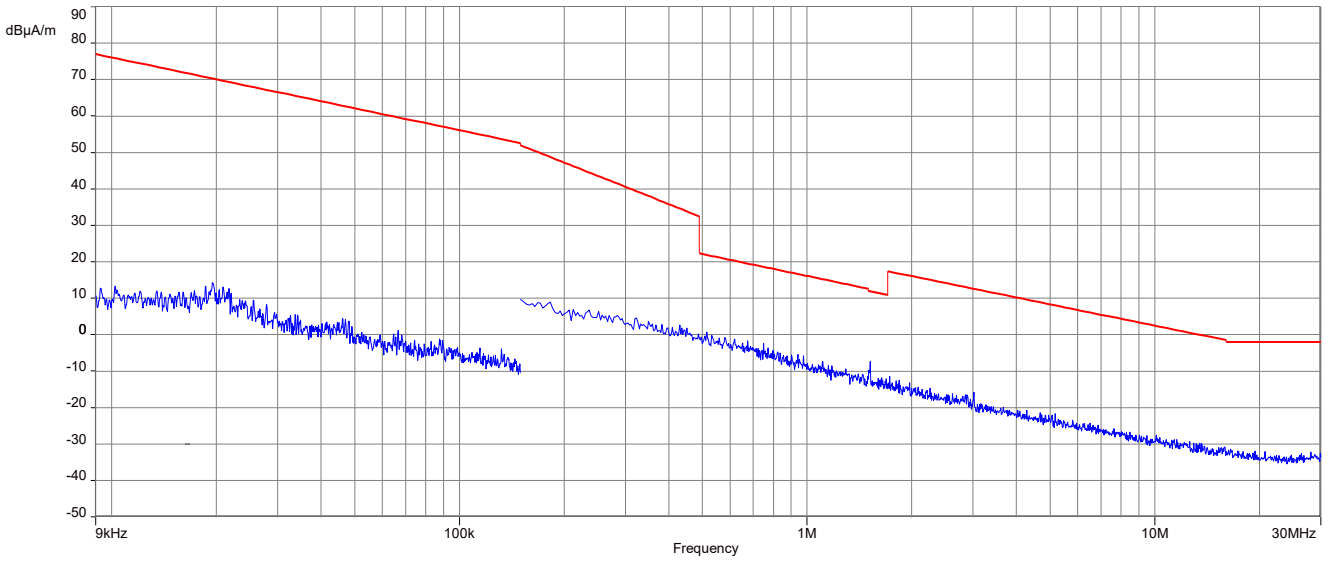
SPURIOUS EMISSIONS LEVEL [dBµV/m]								
Lowest channel			Middle channel			Highest channel		
Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]
All emissions were more than 10 dB below the limit.								

Plots antenna: ANT.U82/82

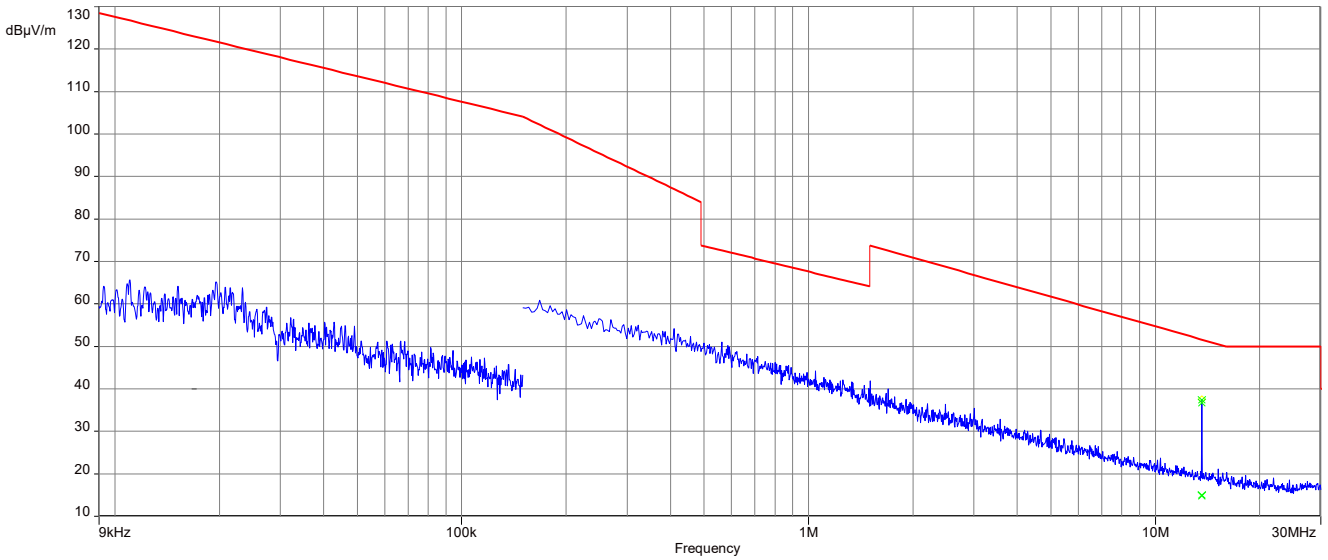
Plot 1: tx mode low channel FCC



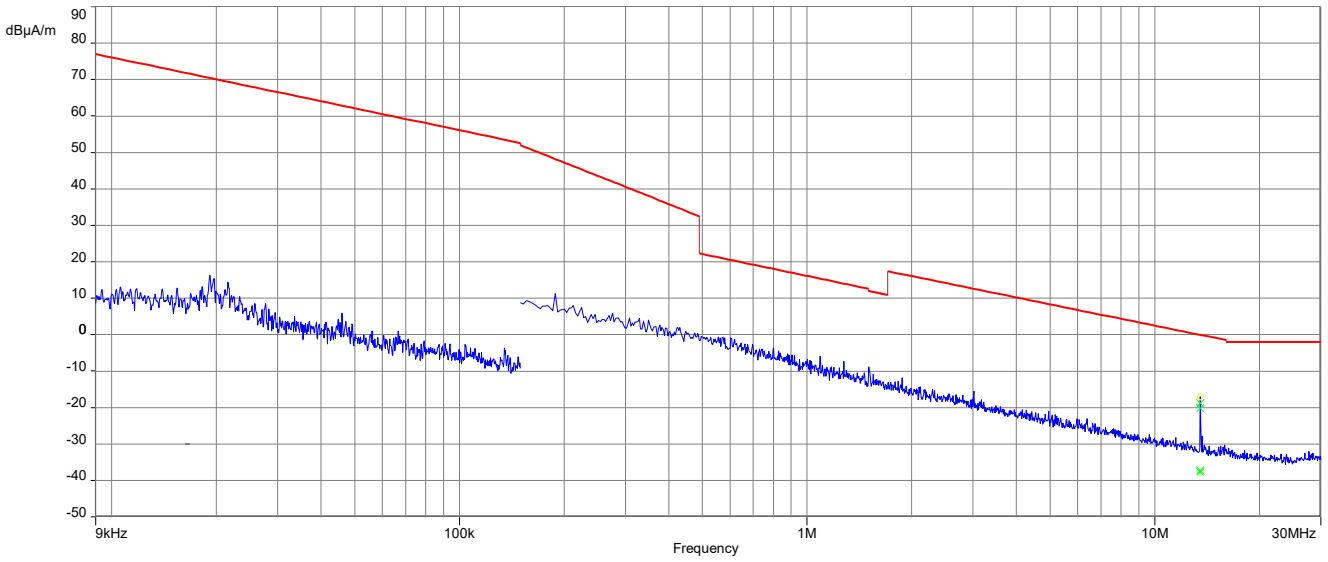
Plot 2: tx mode low channel IC



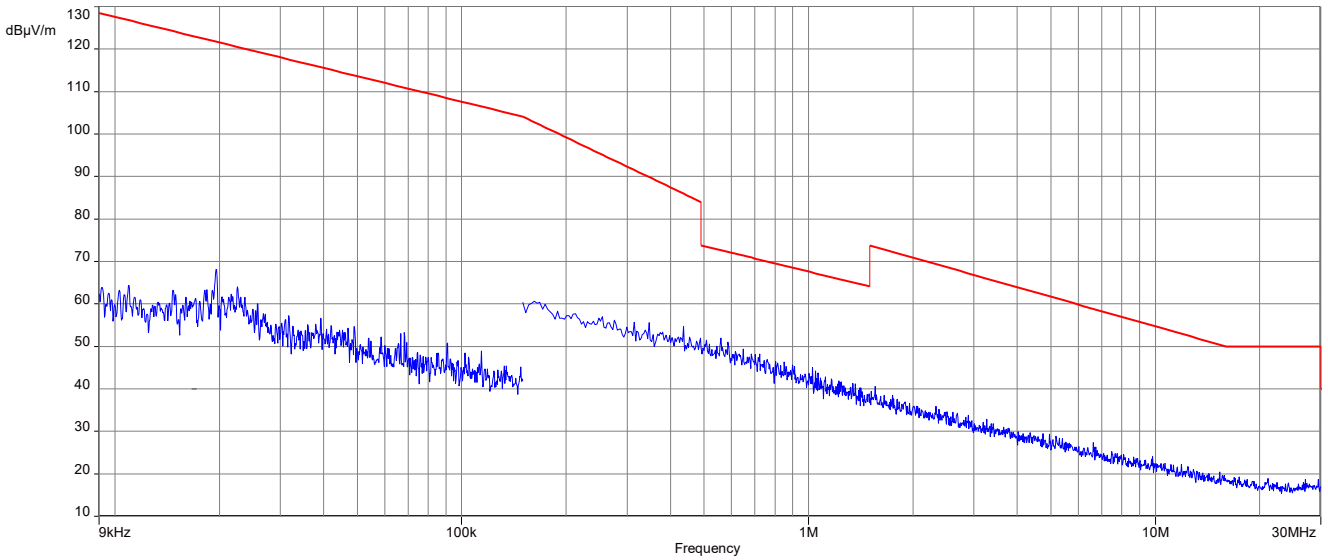
Plot 3: tx mode mid channel FCC



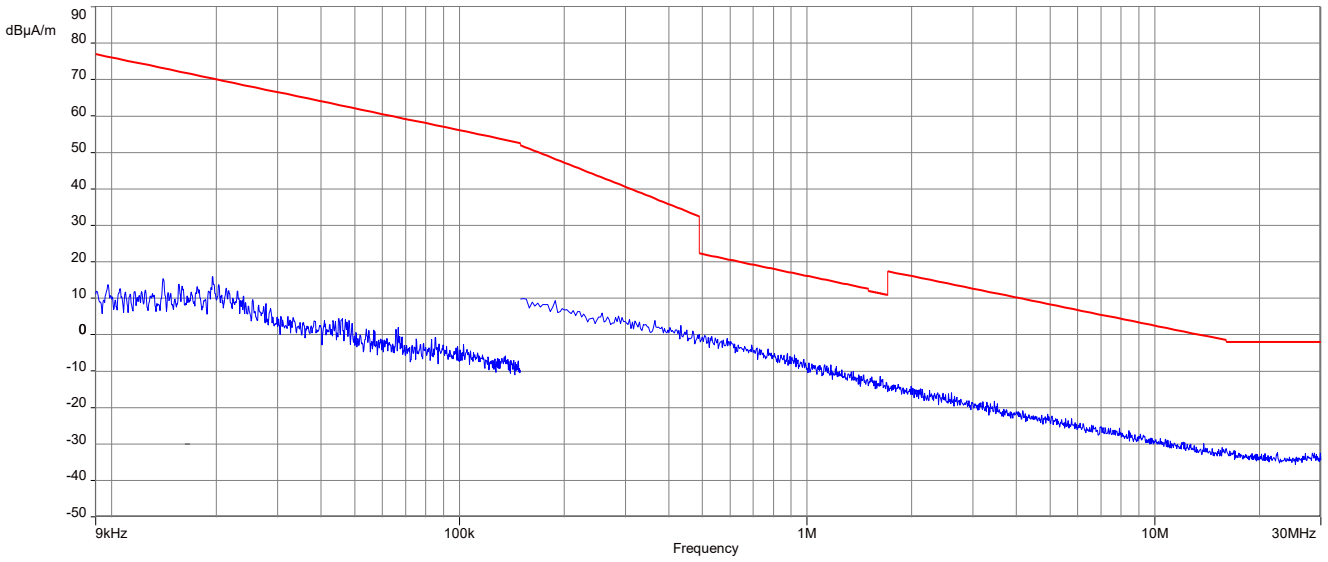
Plot 4: tx mode mid channel IC



Plot 5: tx mode high channel FCC

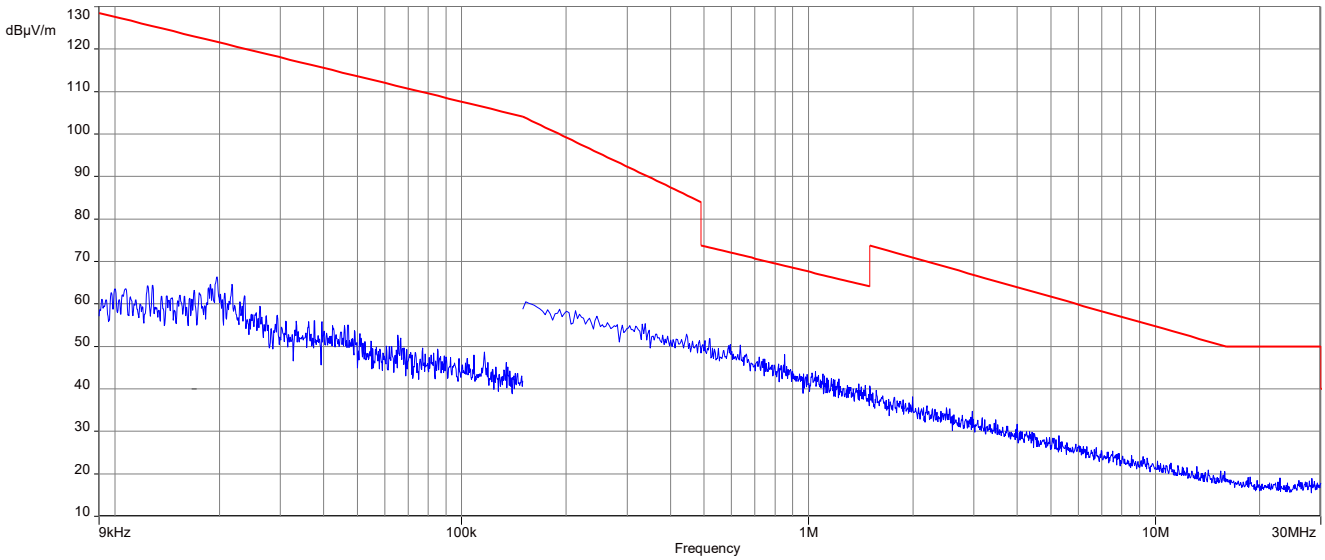


Plot 6: tx mode high channel IC

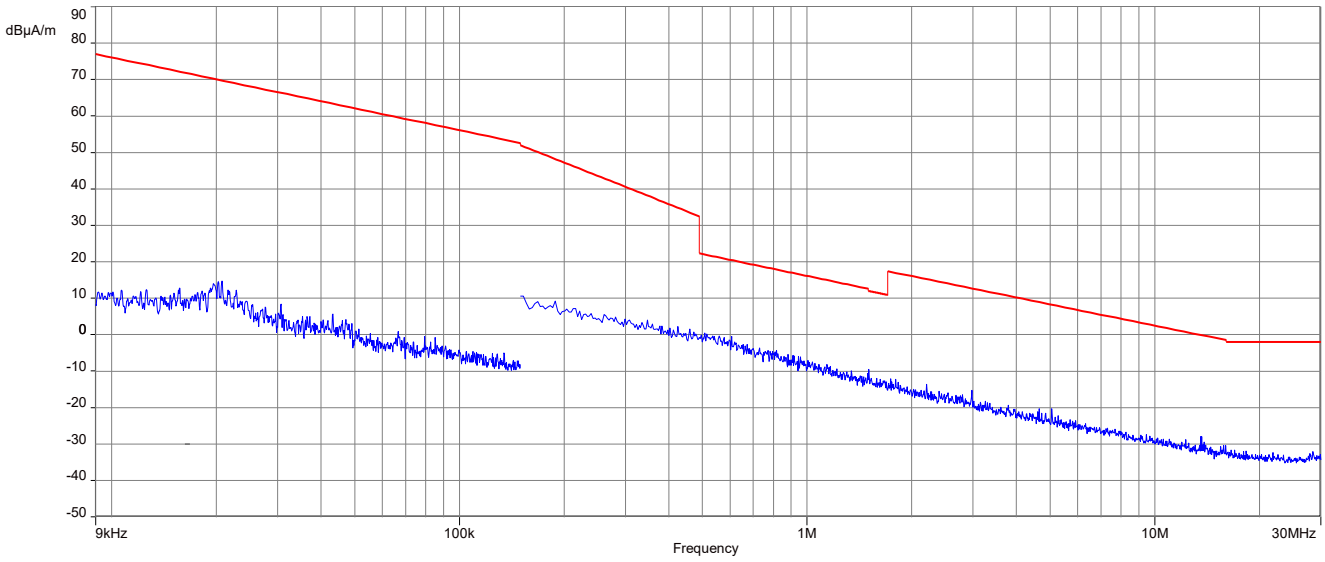


Plots antenna: ID ANT.U LOCFIELD 037-080-28-FCC7-080-28-FCC

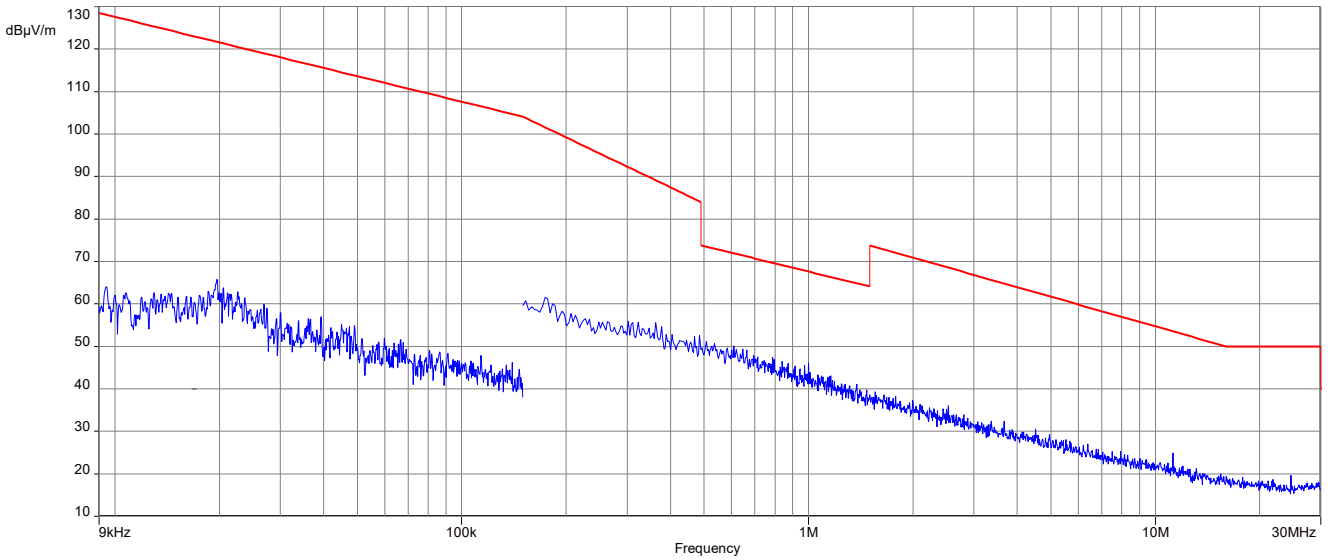
Plot 1: tx mode low channel FCC



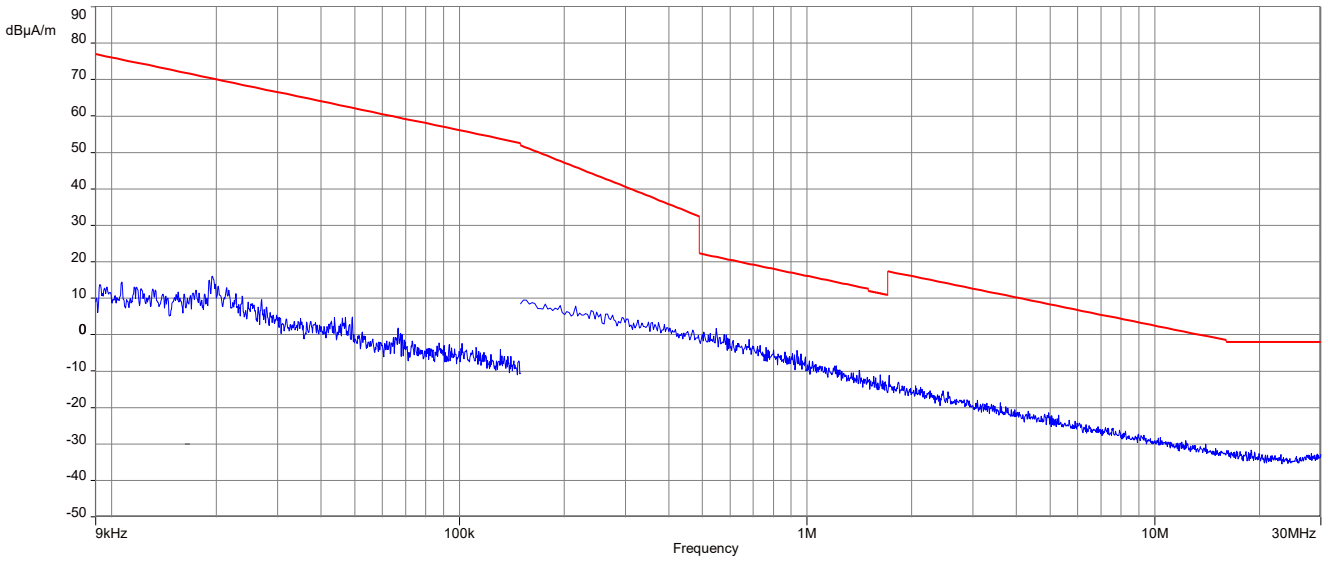
Plot 2: tx mode low channel IC



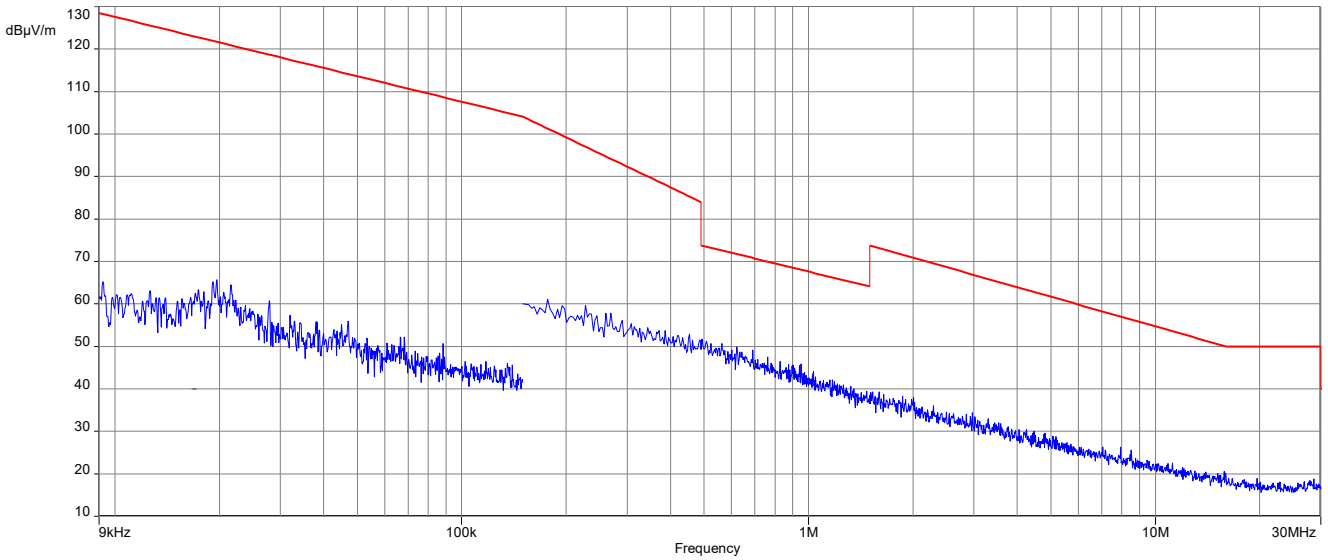
Plot 3: tx mode mid channel FCC



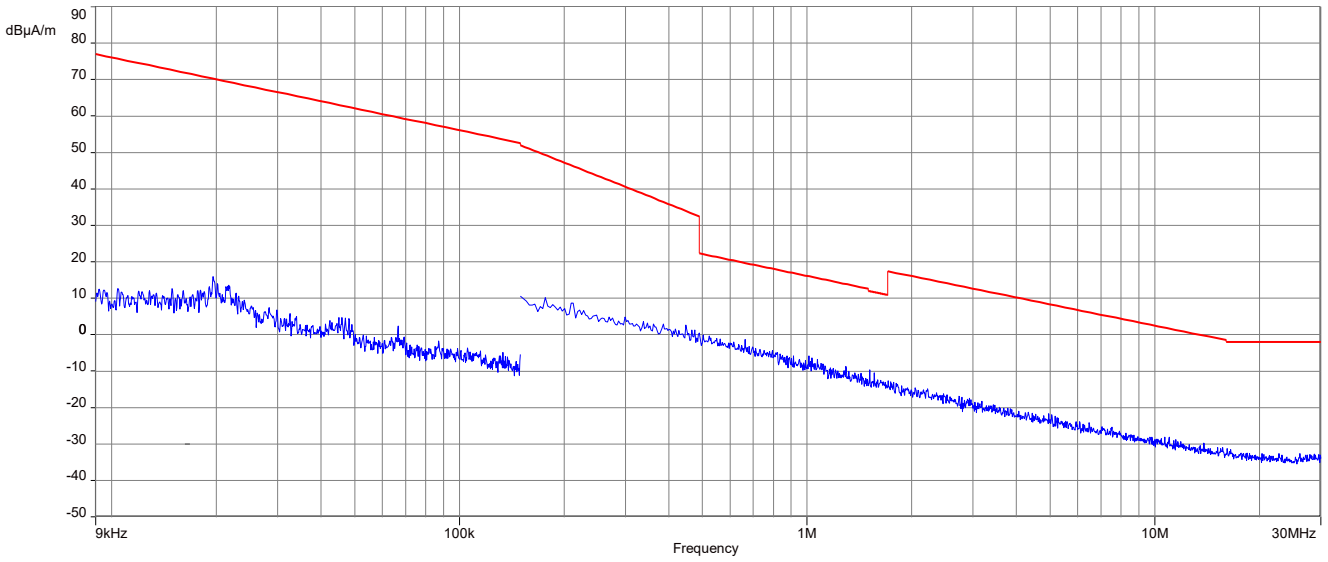
Plot 4: tx mode mid channel IC



Plot 5: tx mode high channel FCC



Plot 6: tx mode high channel IC



12.3 Spurious Emissions Radiated > 30 MHz

12.3.1 Spurious emissions radiated 30 MHz to 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel low, mid and high.

Measurement:

Measurement parameters	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	3 x VBW
Video bandwidth	120 kHz
Span	30 MHz to 1 GHz
Trace mode	Max hold
Measured modulation	PRASK
Test setup	See sub clause 7.1 A
Measurement uncertainty	See sub clause 8

Limits:

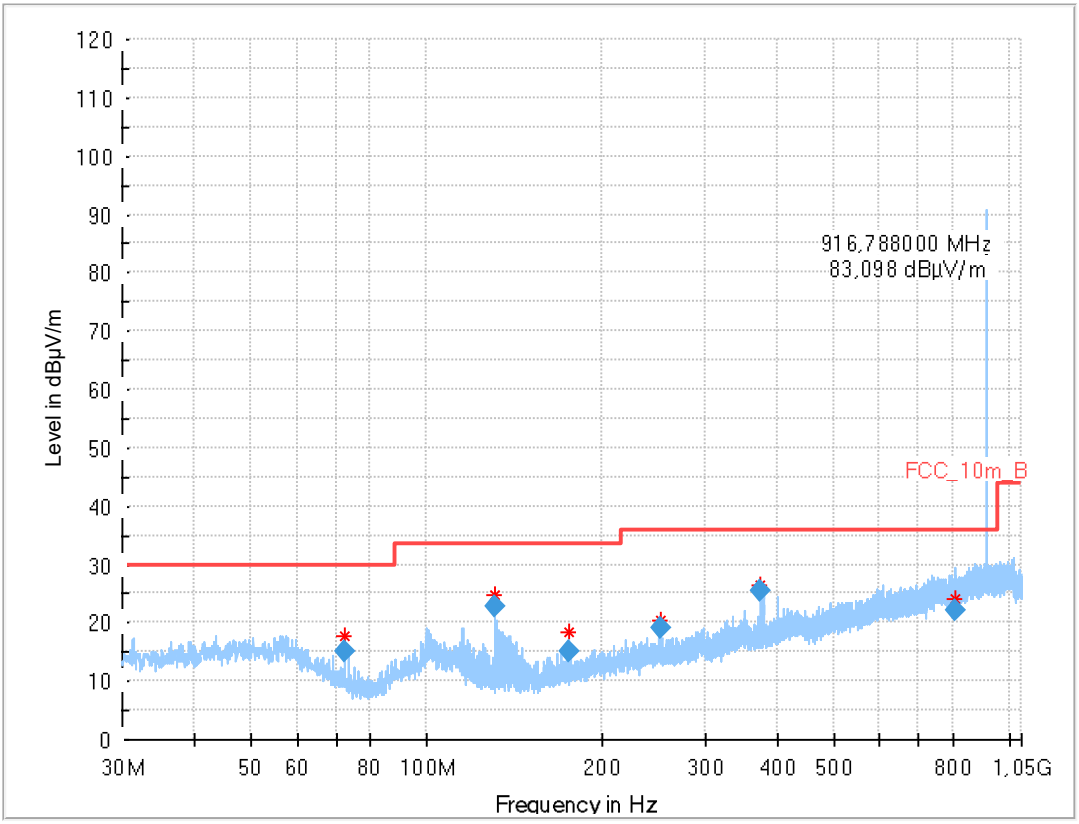
FCC	IC	
Band-edge Compliance of conducted and radiated emissions		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Result:

See result table below the plots.

Plots antenna: ID ANT.U LOCFIELD 037-080-28-FCC7-080-28-FCC

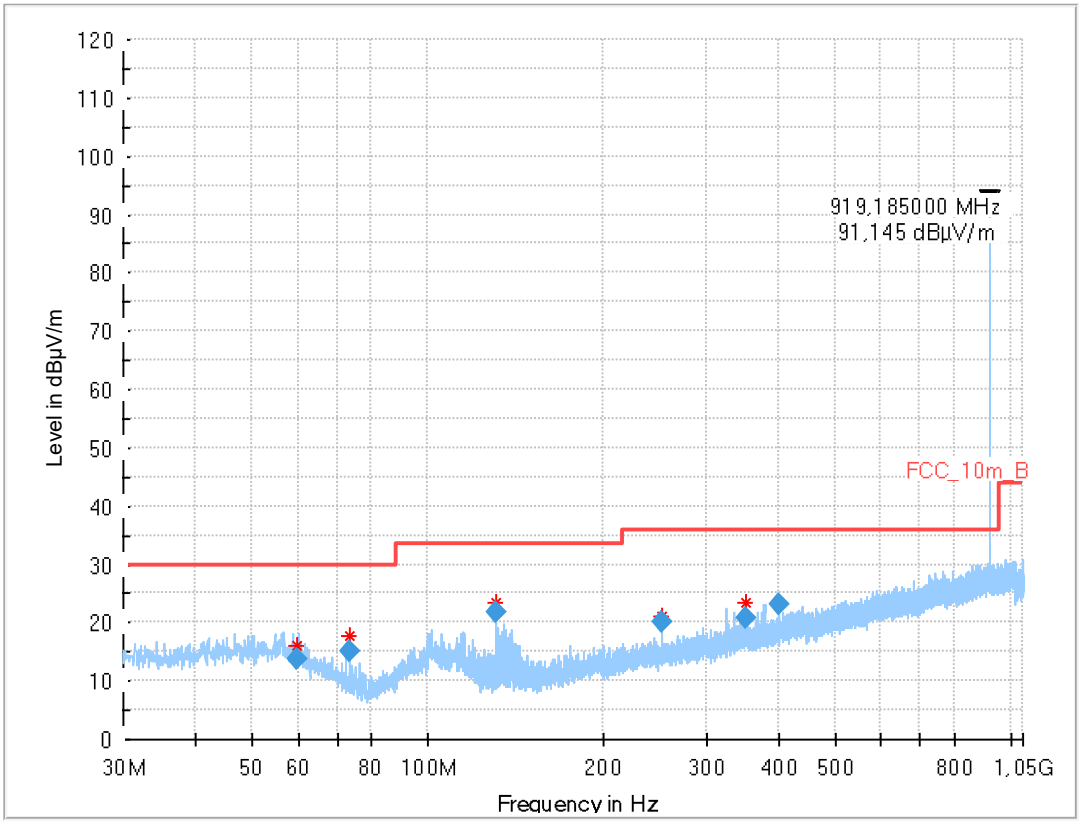
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarisation (lowest channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
72.279	14.97	30.0	15.0	1000	120.0	171.0	V	275	10
130.918	22.82	33.5	10.7	1000	120.0	146.0	V	282	10
175.002	15.08	33.5	18.4	1000	120.0	104.0	V	28	11
251.974	19.26	36.0	16.7	1000	120.0	103.0	V	196	14
375.000	25.37	36.0	10.6	1000	120.0	104.0	V	-37	17
806.415	22.20	36.0	13.8	1000	120.0	117.0	V	52	24

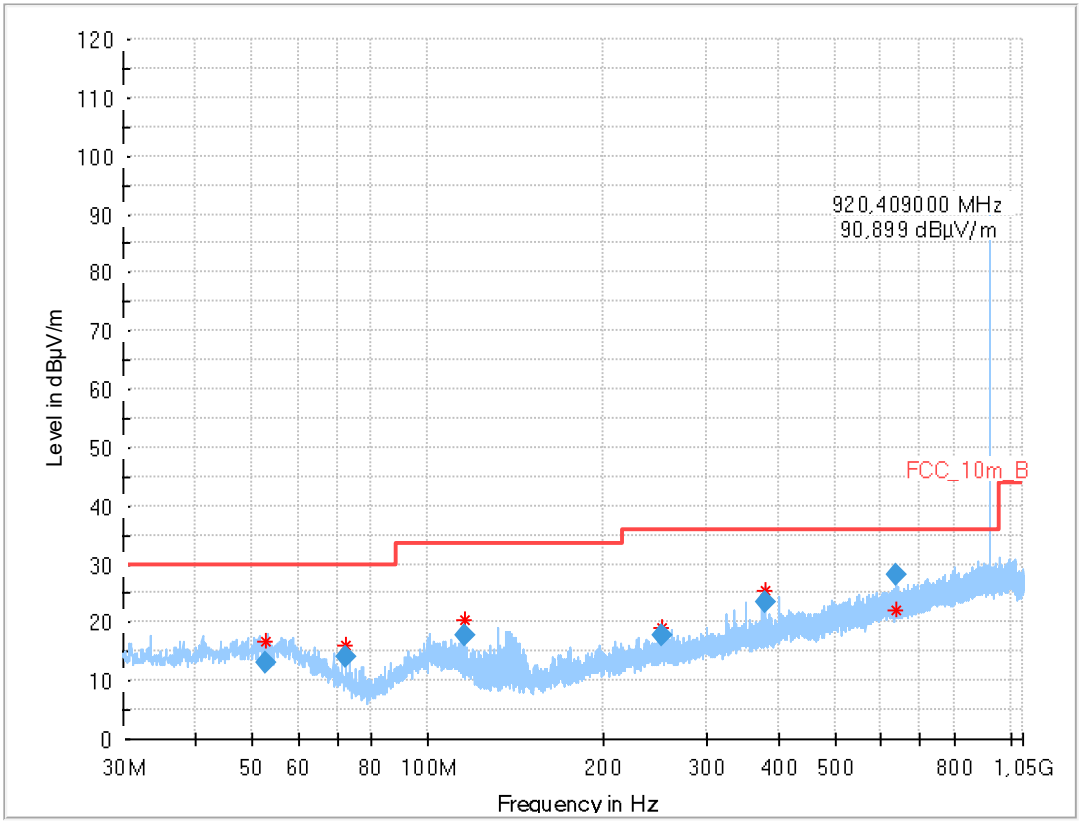
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarisation (middle channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
59.562	13.63	30.0	16.4	1000	120.0	195.0	V	127	14
73.235	14.96	30.0	15.0	1000	120.0	195.0	V	276	9
130.899	21.89	33.5	11.6	1000	120.0	127.0	V	277	10
252.009	20.26	36.0	15.7	1000	120.0	98.0	V	189	14
350.008	20.67	36.0	15.3	1000	120.0	98.0	V	-37	17
399.994	23.03	36.0	13.0	1000	120.0	195.0	H	232	18

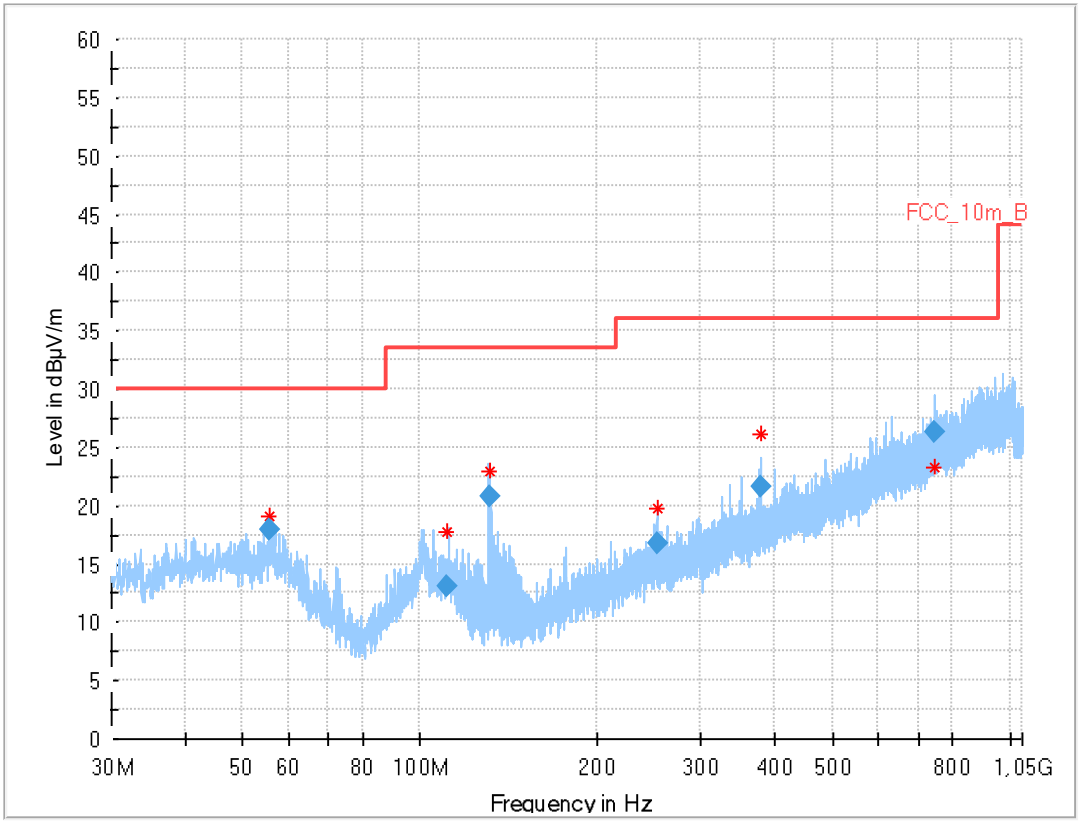
Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarisation (highest channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.734	13.12	30.0	16.9	1000	120.0	175.0	V	27	15
72.237	14.16	30.0	15.8	1000	120.0	133.0	V	-23	10
115.251	17.81	33.5	15.7	1000	120.0	185.0	V	100	12
252.029	17.79	36.0	18.2	1000	120.0	114.0	V	-37	14
378.013	23.63	36.0	12.4	1000	120.0	102.0	V	112	17
634.569	28.24	36.0	7.8	1000	120.0	195.0	V	52	22

Plot 4: 30 MHz – 1 GHz, RX mode, horizontal & vertical polarisation

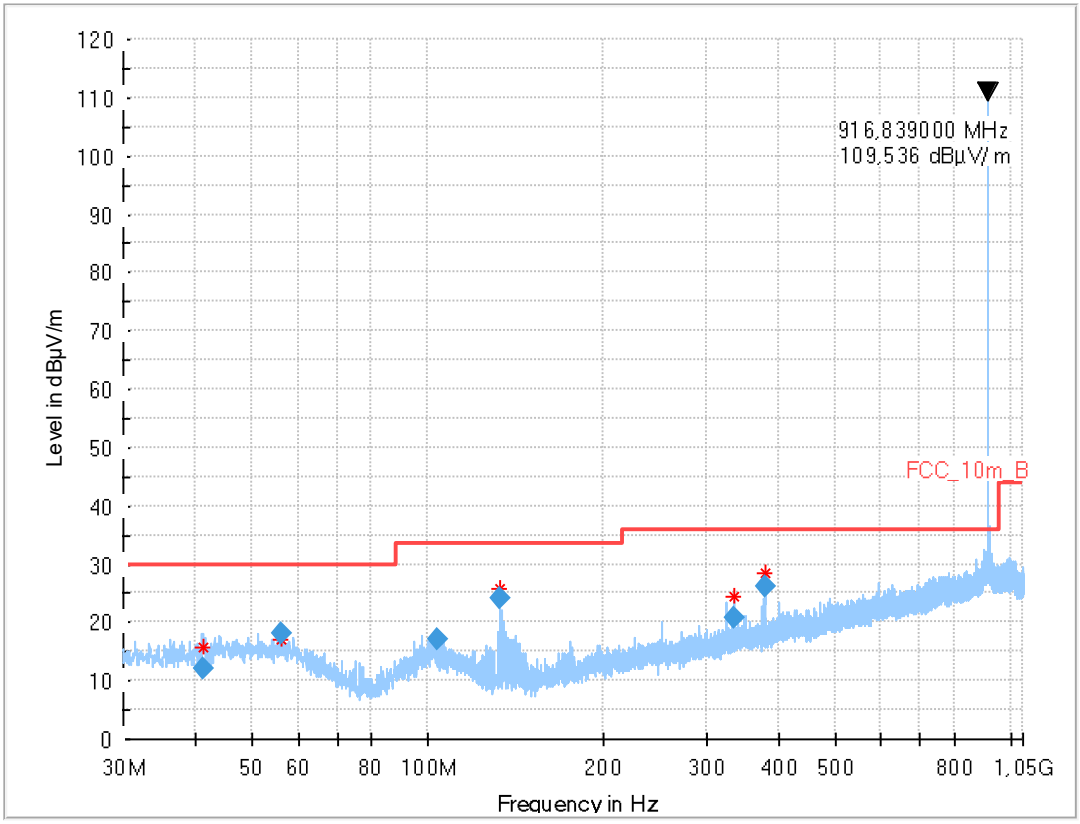


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
55.691	17.88	30.0	12.1	1000	120.0	118.0	V	207	16
111.340	12.99	33.5	20.5	1000	120.0	195.0	V	142	13
130.906	20.84	33.5	12.7	1000	120.0	147.0	V	278	10
252.029	16.74	36.0	19.3	1000	120.0	98.0	V	142	14
377.903	21.68	36.0	14.3	1000	120.0	98.0	V	52	17
743.296	26.38	36.0	9.6	1000	120.0	107.0	H	52	23

Plots antenna: ANT.U82/82

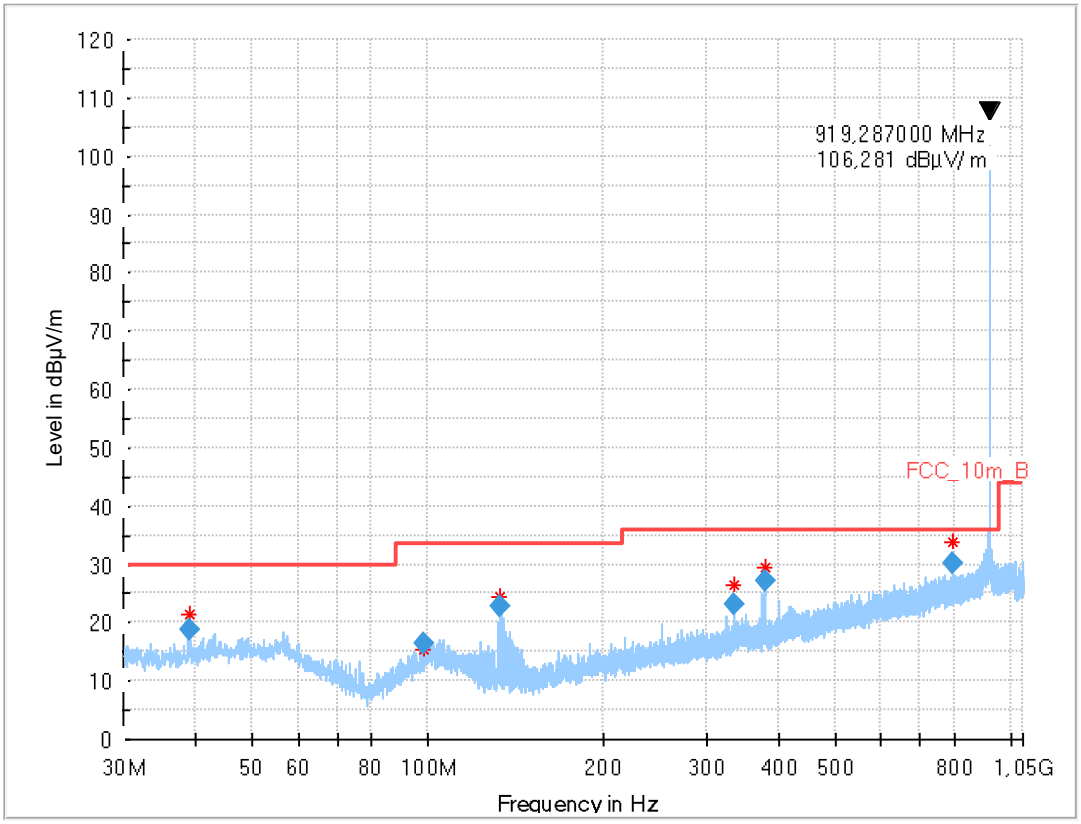
Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarisation (lowest channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
41.057	12.21	30.0	17.8	1000	120.0	177.0	V	162	14
55.978	17.95	30.0	12.1	1000	120.0	152.0	V	232	16
103.538	17.17	33.5	16.3	1000	120.0	109.0	V	127	14
132.821	24.23	33.5	9.3	1000	120.0	127.0	V	-27	10
335.946	20.74	36.0	15.3	1000	120.0	98.0	V	217	16
378.006	26.17	36.0	9.8	1000	120.0	101.0	V	-37	17

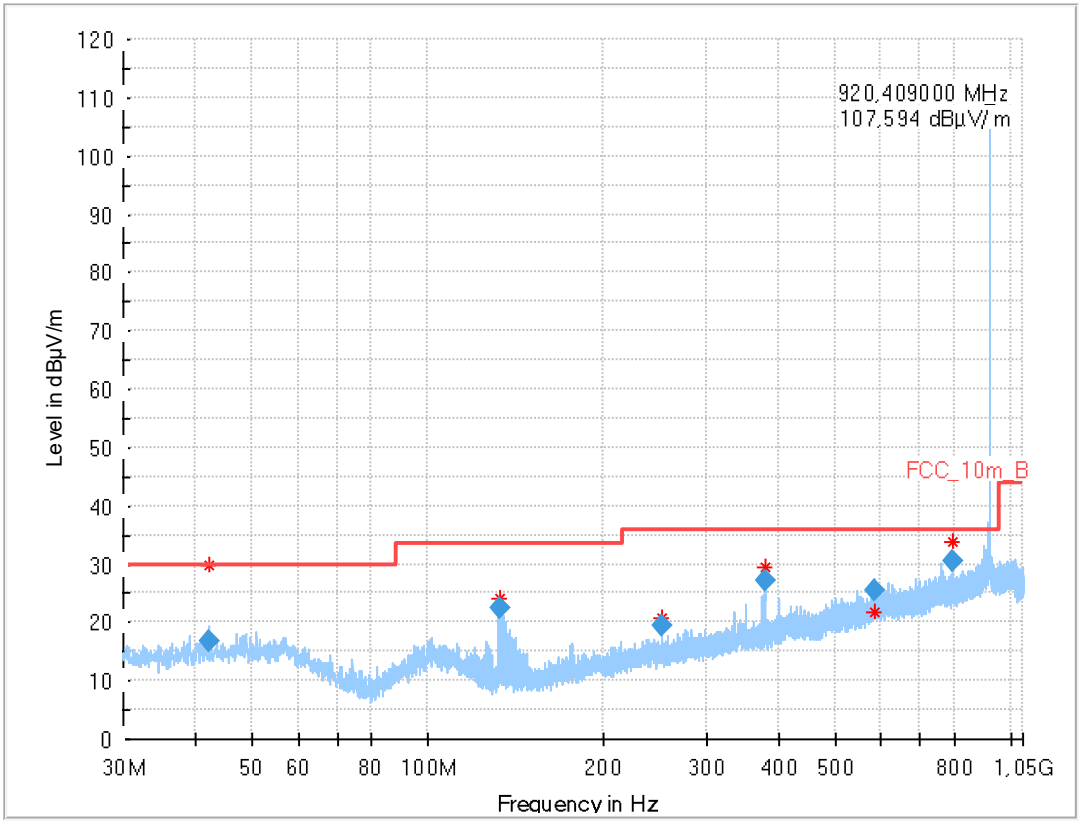
Plot 2: 30 MHz – 1 GHz, horizontal & vertical polarisation (middle channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.061	18.93	30.0	11.1	1000	120.0	162.0	V	286	14
98.649	16.59	33.5	16.9	1000	120.0	128.0	V	166	13
132.836	22.80	33.5	10.7	1000	120.0	142.0	V	174	10
336.019	23.18	36.0	12.8	1000	120.0	98.0	V	-30	16
377.995	27.20	36.0	8.8	1000	120.0	101.0	V	-37	17
797.885	30.23	36.0	5.8	1000	120.0	141.0	H	173	24

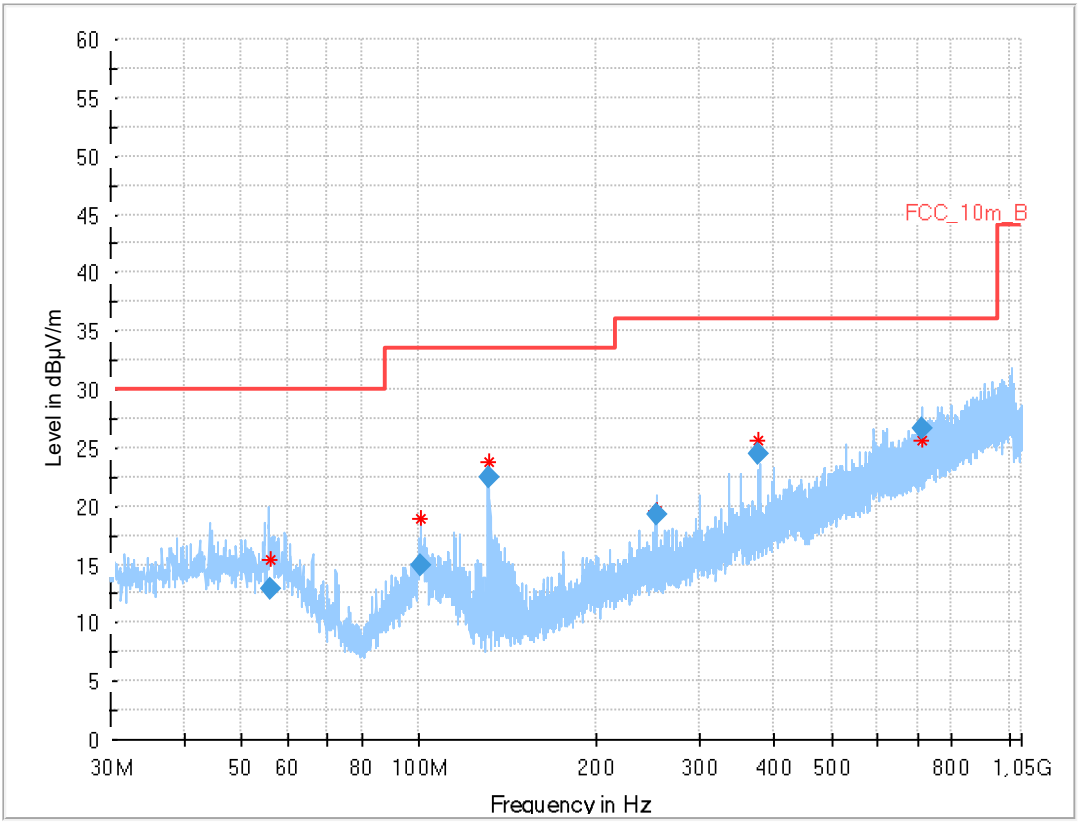
Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarisation (highest channel)



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
41.971	16.92	30.0	13.1	1000	120.0	101.0	V	180	15
132.863	22.52	33.5	11.0	1000	120.0	127.0	V	184	10
252.030	19.46	36.0	16.5	1000	120.0	98.0	V	142	14
377.994	27.21	36.0	8.8	1000	120.0	101.0	V	-34	17
584.943	25.33	36.0	10.7	1000	120.0	115.0	H	142	21
797.912	30.64	36.0	5.4	1000	120.0	133.0	H	167	24

Plot 4: 30 MHz – 1 GHz, RX mode, horizontal & vertical polarisation



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
56.110	12.93	30.0	17.1	1000	120.0	118.0	H	206	16
100.598	14.99	33.5	18.5	1000	120.0	165.0	V	7	13
130.890	22.48	33.5	11.0	1000	120.0	128.0	V	272	10
252.015	19.19	36.0	16.8	1000	120.0	102.0	V	142	14
375.009	24.55	36.0	11.5	1000	120.0	98.0	V	307	17
713.971	26.58	36.0	9.4	1000	120.0	110.0	H	142	22

12.3.2 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 26 GHz
Trace mode	Max hold
Measured modulation	PRASK
Test setup	See sub clause 7.2 C (1 GHz – 12.75 GHz)
Measurement uncertainty	See sub clause 9

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

ANSI C63.10
The average emission shall be determined by using RMS detector. If the dwell time of the hopping signal is less than 100 ms (per channel), the RMS reading may be adjusted by a factor: F = 20log (dwell time/100 ms)

FCC		IC
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance
Above 960	54.0 (average) 74.0 (peak)	3

Result:

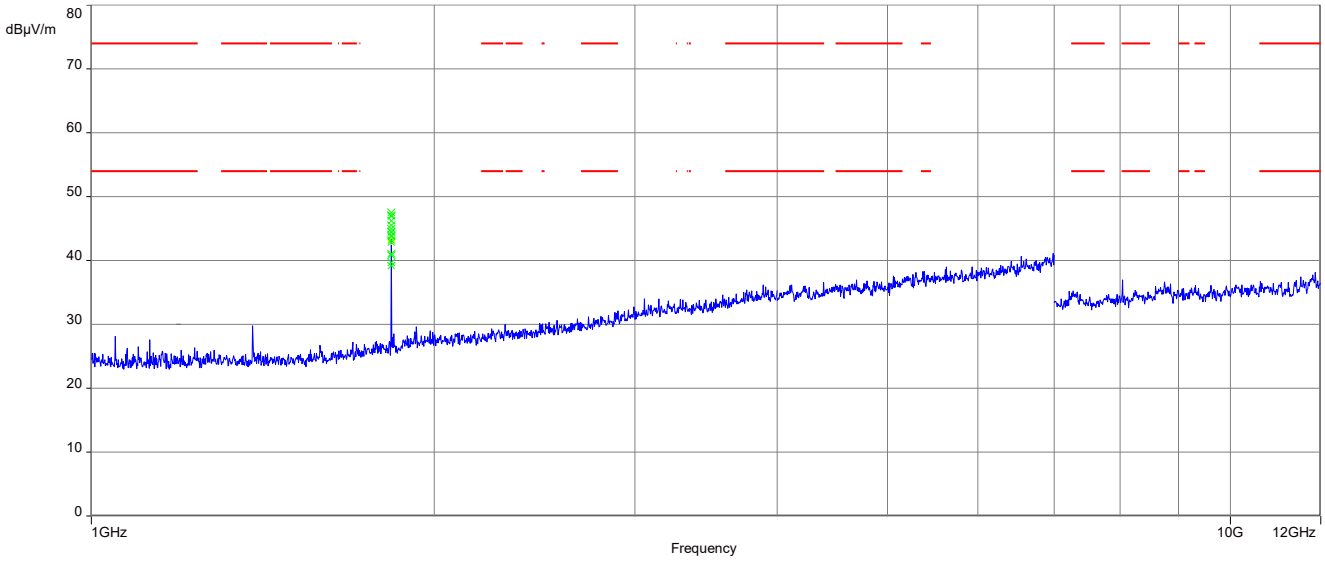
TX spurious emissions radiated [dBµV/m] with antenna ANT.U82/82								
lowest channel			middle channel			highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1833.5	Peak	47.51	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	45.52		AVG	-/-		AVG	-/-
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-

TX spurious emissions radiated [dBµV/m] with antenna ID ANT.U LOCFIELD 037-080-28-FCC7-080-28-FCC								
lowest channel			middle channel			highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1833.5	Peak	51.07	1838.4	Peak	51.69	2761.1	Peak	44.65
	AVG	49.58		AVG	50.39		AVG	40.35
-/-	Peak	-/-	2756.3	Peak	46.31	-/-	Peak	-/-
	AVG	-/-		AVG	39.20		AVG	-/-

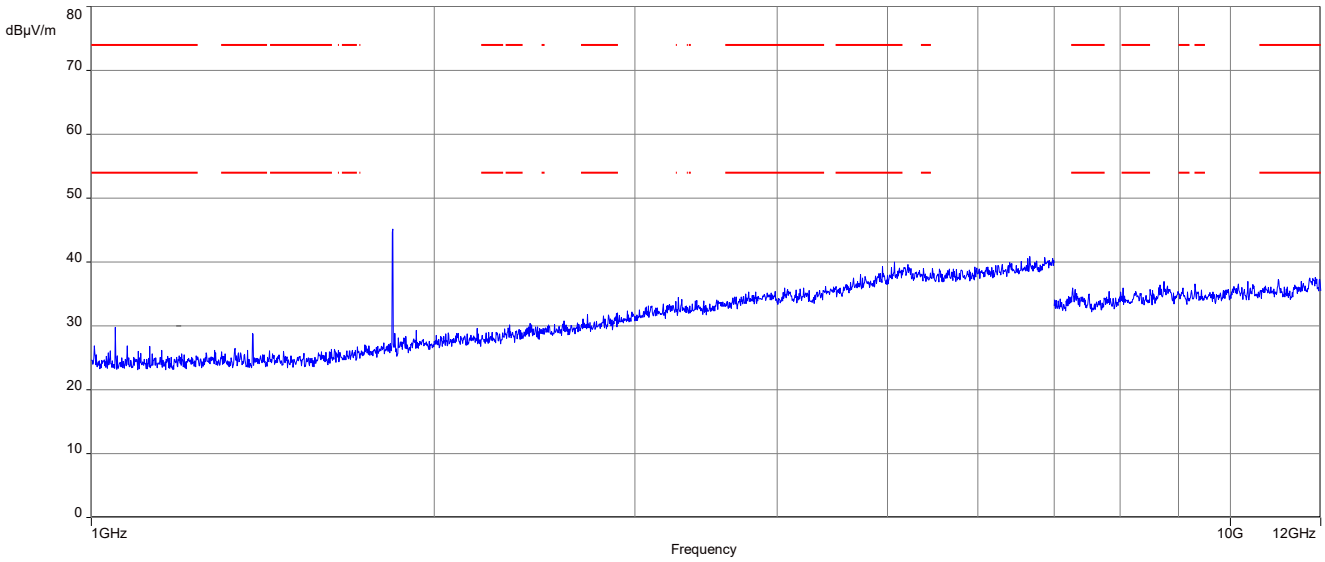
Plots:

Plots antenna: ANT.U82/82

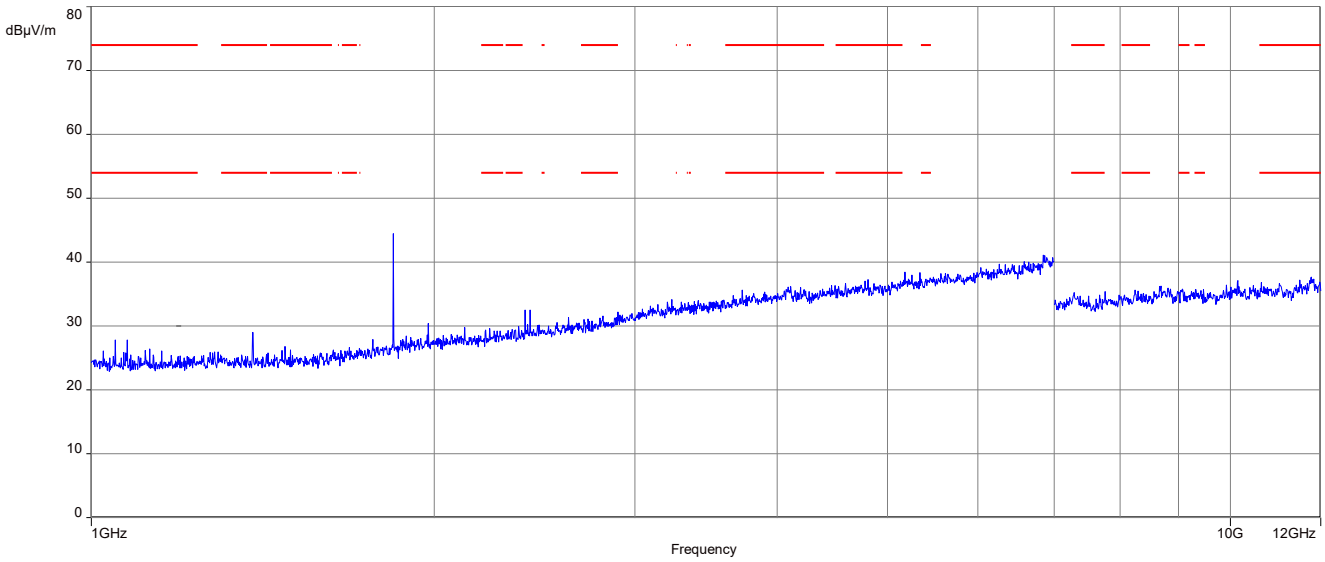
Plot 1: 1 GHz – 12 GHz, horizontal & vertical polarisation (lowest channel)



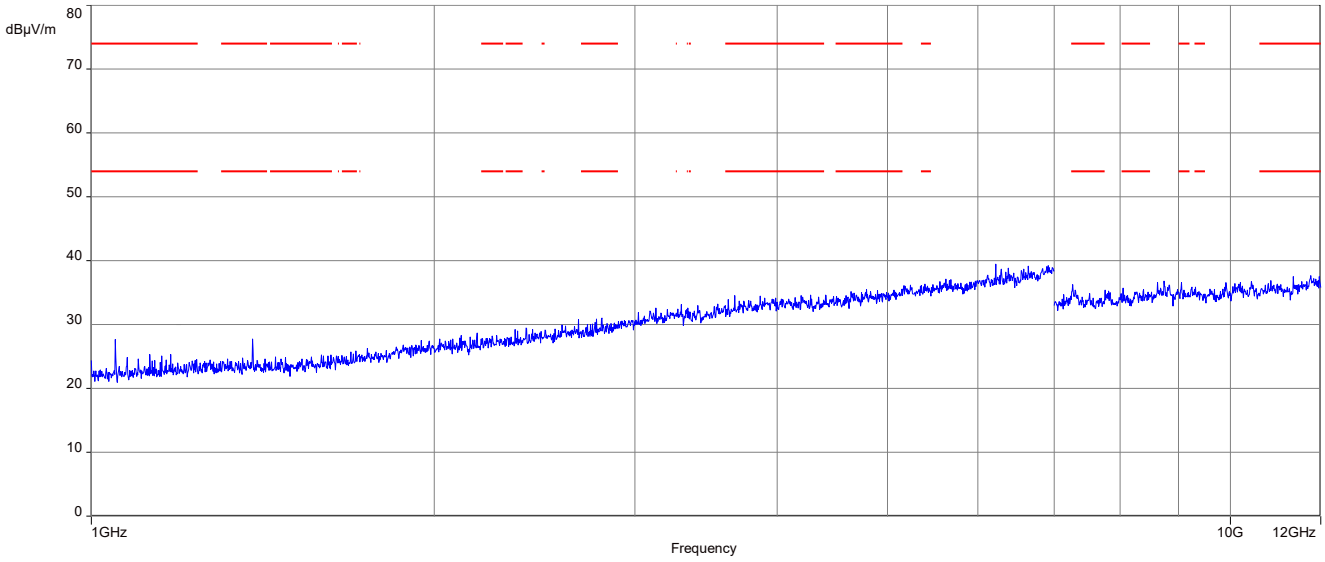
Plot 2: 1 GHz – 12 GHz, horizontal & vertical polarisation (middle channel)



Plot 3: 1 GHz – 12 GHz, horizontal & vertical polarisation (highest channel)

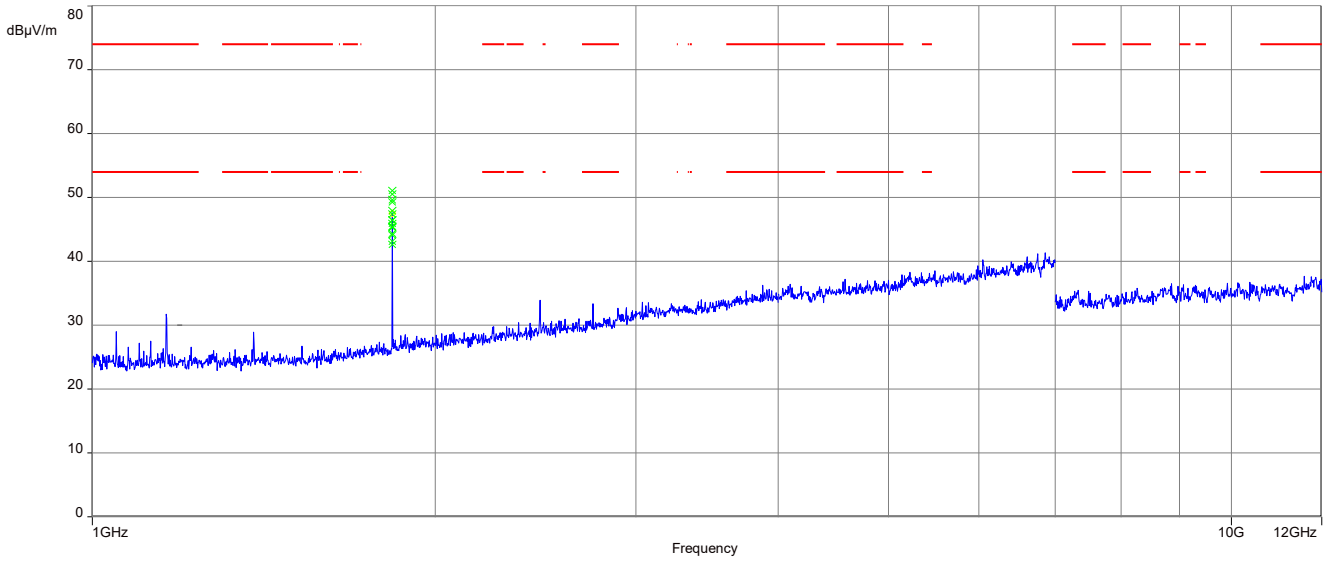


Plot 4: 1GHz – 12 GHz, RX-Mode, horizontal & vertical polarisation

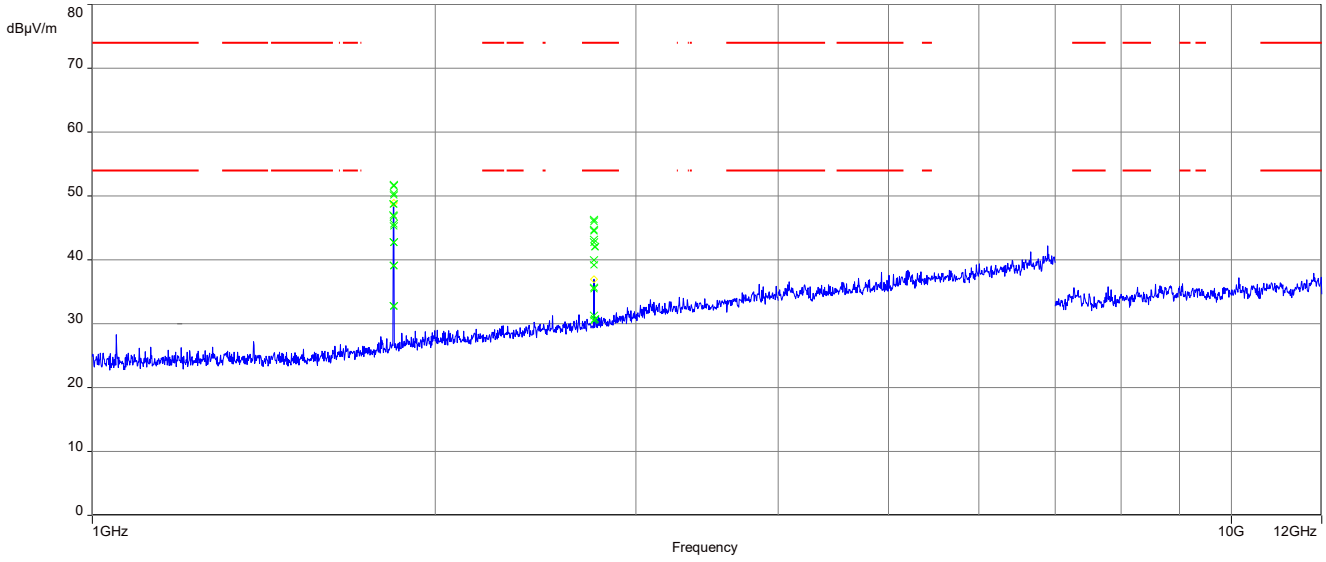


Plots antenna: ID ANT.U LOCFIELD 037-080-28-FCC7-080-28-FCC

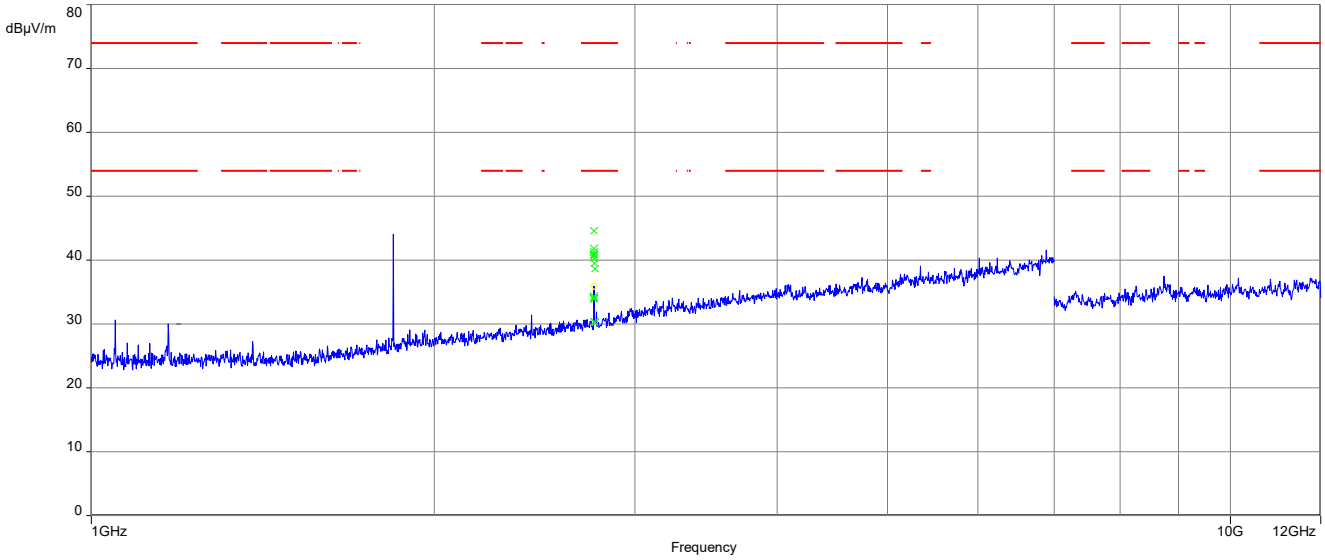
Plot 1: 1 GHz – 12 GHz, horizontal & vertical polarisation (lowest channel)



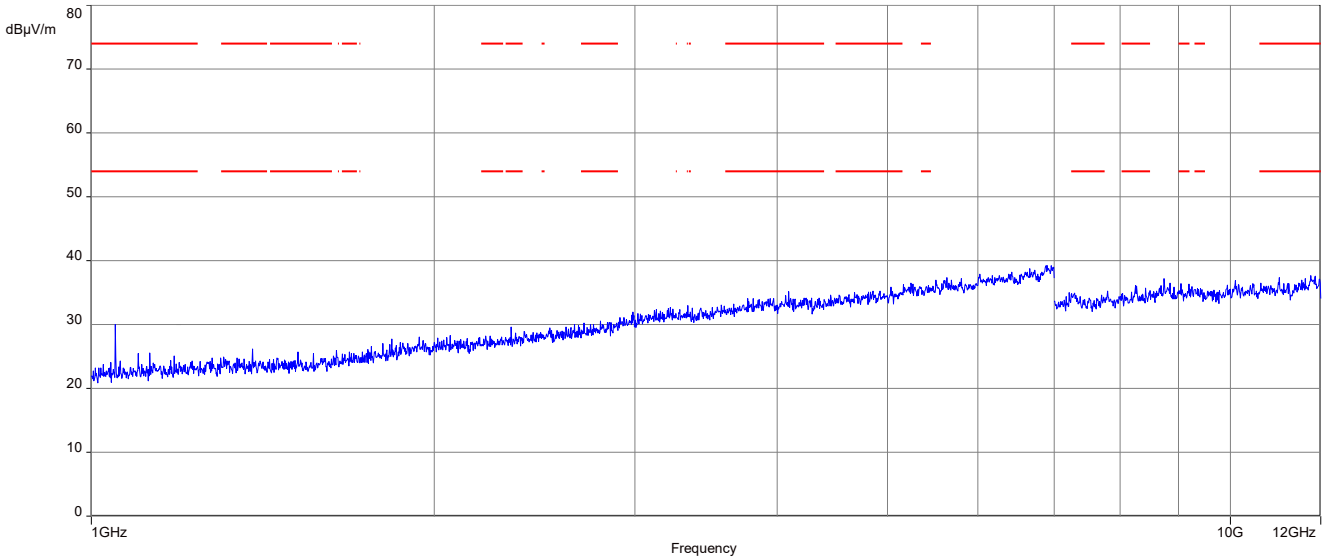
Plot 2: 1 GHz – 12 GHz, horizontal & vertical polarisation (middle channel)



Plot 3: 1 GHz – 12 GHz, horizontal & vertical polarisation (highest channel)



Plot 4: 1GHz – 12 GHz, RX-Mode, horizontal & vertical polarization



13 Glossary

AVG	Average
C	Compliant
C/N$_0$	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DFS	Dynamic frequency selection
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EN	European Standard
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
GNSS	Global Navigation Satellite System
GUE	GNSS User Equipment
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
IC	Industry Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2024-02-13

########## END OF TEST REPORT ##########